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United States
Department of
Agriculture

Forest Service

Southeastern Forest
Experiment Station

FOREST RESEARCH in the SOUTHEAST

October 1985

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Recent Publications of the Southeastern Forest Experiment Station

Mycorrhizal Technology Works on a Practical Scale

For several years, scientists at the Station's Institute for Mycorrhizal Research and Development have been describing the benefits of inoculating nursery seedlings with the mycorrhizal fungus Pisolithus tinctorius (Pt). In carefully controlled research studies, seedlings with Pt ectomycorrhizae dominant on their root systems grew larger in the nursery. Furthermore, they often outperformed seedlings with naturally occurring ectomycorrhizae after outplanting.

Questions remained about the practicality of inoculation under operational conditions in nurseries. Could effective inoculum be mass produced in a commercial laboratory? Could inoculation techniques be applied in typical nurseries around the country? "Yes" and "Yes" are the answers to these questions, but these conclusions were not easily reached. They required several years of work with a commercial laboratory and field tests under existing conditions in 33 nurseries in 25 States.

Commercial inoculum was produced in solid substrate fermentors by Abbott Laboratories starting in 1977, but mass production proved to be more difficult than anticipated. Most of the batches produced in 1977 and 1978 were ineffective for inoculating seedlings. Fermentation conditions were altered, and in 1979 and 1980 most batches produced by Abbott Laboratories were as effective as those produced for research purposes at the Mycorrhizal Institute.

Environmental conditions and cultural treatments vary widely among forest nurseries.

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Approximately equal parts of art and science go into the management of a nursery, with different nurserymen finding different solutions to the same problems. Fumigation schedules and techniques, watering and fertilization schedules, sowing techniques, target densities for seedbeds, weed control, insect and disease control, and lifting and grading procedures vary widely among nurseries. It is not surprising, therefore, that Pt inoculation was initially successful in some nurseries but not in others.

In some instances, the cause of failure became evident; in others, it did not. The development of commercial vegetative inoculum of Pt and the methods and results for the nursery tests are described in a 101-page FOREST SCIENCE Monograph. That publication is important reading for nurserymen who are considering Pt inoculation in their nursery. Single copies can be obtained by checking R-943 on the back cover.

Pine Regeneration After Winter Harvest

Upland forests on the Piedmont Plateau of the Southeast are dominated by low-quality hardwoods mixed with pines. Many of the stands have been high-graded, and forest production would be improved by replacing the existing stands with more desirable ones. Logging for conventional products is seldom feasible, but whole-tree harvesting for fuelwood chips holds much promise.

What kind of regeneration can an owner expect after the harvest of all but the smallest stems from such stands? A recently completed study indicates that a good deal of pine regeneration can be expected if pines are abundant in the old stand and if logging is done in the winter.

In the study, the treated stands were about 25 percent pine and 75 percent hardwood. Pine diameters ranged from 1 to 14 inches d.b.h., and

hardwood from 1 to 20 inches. Plots were established to compare winter and summer treatment and harvesting to a 1-inch and a 4-inch diameter limit. Harvesting was done in January and June of 1980.

After 2 years, there were 7,709 pine seedlings per acre on plots logged to the 1-inch diameter limit in the winter. There were 1,829 pines per acre on the plots logged in the winter to a 4-inch limit. Plots logged to the same limits in the summer had insignificant numbers of pine seedlings (34 and 17 per acre) 2 years after cutting.

On plots with large numbers of pine seedlings, some form of release will probably be needed to help the pines dominate the new stand. Nevertheless, the study demonstrates that respectable, desirable, new stands can be obtained after fuelwood harvests in undesirable pine-hardwood stands on the Piedmont.

Reprints of an article describing the study and the early results may be obtained by checking R-939 on back cover.

Straight Studs From Yellow-Poplar

Throughout the Southern Appalachians and in much of the Piedmont Plateau, yellow-poplar growth exceeds cut by a wide margin. The large volumes of this which are accumulating represent a major opportunity for expansion by forestry industry. The most obvious use for this species, which is famed for its rapid growth and straight stems, is in framing lumber. Until recently, however, excessive warping prevented production of yellow-poplar studs on a major scale.

Wood scientists at the USDA Forest Service Forest Products Laboratory in Madison, WI, have developed a system for making straight studs from yellow-poplar. This system could open the way to a major expansion of forest industry in the South.

The system, called Saw-Dry-Rip, is simple but effective. At the mill, logs are sawed into 1-3/4-inch flitches by making parallel cuts through the log. The flitches, which are much wider than studs, are dried before being ripped and surfaced to the standard stud size of 1-1/2 by 3-1/2 inches. It is during drying when warping has occurred in yellow-poplar and similar woods, and much less warping occurs in the flitches than in members that are sawed to their final size before drying.

A research paper and two recent journal articles by scientists at the Forest Products Laboratory describe the system and report yields of satisfactory studs after conventional and high-temperature drying. Copies of all three publications can be obtained by checking numbers R-934, R-941, and R-942 on the back cover.

Precommercial Thinning of Yellow-Poplar Stands

The primary commercial value of yellow-poplar is for solid wood products such as lumber and veneer. As a result, tree size and quality are very important in the management of this species. For pines, it is generally accepted that thinning early and often will produce the most sawtimber in the shortest possible time. There are often good markets for the small trees removed in pine thinnings, however. Sale of the trees that are removed in early thinnings of yellow-poplar stands probably cannot be anticipated. Thinnings before about age 25 probably have to be regarded as precommercial.

Will such treatments meaningfully increase the growth of the remaining trees in yellow-poplar stands? A study in the Southern Appalachians shows that they will. Are the increases in growth worth the expense of treatment? That depends on the stumpage prices, trees of different grades, and the rates of return that one expects from investments. It appears that precommercial thinning is worthy of consideration.

These are the principal findings of a yellow-poplar thinning study. Some parts of a 15-year-old yellow-poplar plantation were thinned and some were not. Seven years later, the mean d.b.h. of crop trees was 0.8 inch larger in thinned areas than in unthinned areas. The results suggest that pre-commercial thinning will reduce the length of rotations for production of yellow-poplar saw logs.

Reprints of the results of this study may be obtained by checking N-335 on the back cover.

List of Recent Publications

RB-78 Bechtold, William A.
Forest statistics for North Carolina, 1984. Rescur. Bull. SE-78. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985; 62 pp.

Since 1974 the area of commercial forest declined from 19.5 to 18.5 million acres. More than 2.5 million acres were harvested and retained in timberland. Over 2.1 million acres were regenerated to manageable stands of growing-stock trees. Softwood growing-stock volume rose from 10.5 to 11.2 billion cubic feet; hardwood growing stock, from 15.6 to 17.7 billion cubic feet.

R-930 Berry, C.R.
Subsoiling and sewage sludge aid loblolly pine establishment on adverse sites. Reclamation and Revegetation Research 3:301-311; 1984/85.

Loblolly pines on sludge plots grew an average of 37 percent more in height and 76 percent more in d.b.h. than trees on fertilized plots. On fertilized plots, trees grew faster on plots subsoiled 46 cm deep than on plots subsoiled 92 cm deep from which, apparently, there was more leaching of nutriants.

P-250 Clark, Alexander, III; Phillips, Douglas R.; Frederick, Douglas J.
Weight, volume, and physical properties of major hardwood species in the Gulf and Atlantic Coastal Plains. Res. Pap. SE-250. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 66 pp.

Values are provided for green ash, blackgum, red maple, sweetgum, water tupelo, yellow-poplar, hickory, laurel oak, water oak, and white oak.

RB-77 Craver, Gerald C.
Forest statistics for the Mountain Region of North Carolina, 1984. Resour. Bull. SE-77. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 50 pp.

Since 1974, the area of commercial forest land in the Mountains of North Carolina declined by over 106,000 acres, or by almost 3 percent. Mortality of growing stock totaled 47 million cubic feet, up 72 percent. Net growth still exceeds removals by 26 percent for softwoods and by 221 percent for hardwoods.

N-331 Davenport, Edgar L.
Pulpwood prices in the Southeast, 1983. Res. Note SE-331. Asheville, NC: Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 3 pp.

Pulpwood expenditures across the Southeast totaled $1.3 billion in 1983, up 9.7 percent from the previous year. The average prices paid per ton for green chips and sawdust declined for both softwood and hardwood.

N-334 Drooz, A.T.; Barham, R.W.
Ooencyrtus ennomophagus (Hymenoptera: Encyrtidae) development in chilled vs. unchilled unfertilized eggs of _Eutrapela clemataria_ (Lepidoptera: Geometridae). Res. Note SE-334, Asheville, NC: U.S. Department of Agriculture, Forest Service,

Southeastern Forest Experiment Station; 1985. 2 pp.

The parasite Ooencyrtus ennomophagus developed as well in month-old chilled eggs as it did in fresh unfertilized eggs of Eutrapela clemataria.

N-336 Duff, John E.; Koenigshof, Gerald A. **Durability and dimensional stability of COM-PLY® joists determined by accelerated aging test.** Res. Note SE-336. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 6 pp.

COM-PLY® joists were subjected to accelerated aging and water soaking in laboratory tests to determine their strength, deflection, dimensional stability, and warpage. All of the requirements of the Performance Standards for durability and dimensional stability for COM-PLY joists were met except for thickness swell. In the durability test, COM-PLY joists outperformed No. 2 southern pine joists.

R-931 Dwinell, L.D. **Relative susceptibilities of five pine species to three populations of the pinewood nematode.** Plant Disease 69(5):440-442; 1985.

Seedlings of eastern white, loblolly, pond, slash, and Virginia pines were inoculated with three populations of the pinewood nematode. Pine mortality and susceptibility rank were highest for slash pine, moderate for eastern white, loblolly, and pond pines, and lowest for Virginia pine, which was highly resistant. Mortality was also significantly related to differences in virulence of nematode populations.

R-932 Fatzinger, Carl W.; Merkel, Edward P. **Oviposition and feeding preferences of the southern pine coneworm (Lepidoptera: Pyralidae) for different host-plant materials and observations on monoterpenes as an oviposition stimulant.** Journal of Chemical Ecology 11(6):689-699; 1985.

Bioassays with first-stage larvae and newly emerged females of the southern pine coneworm, Dioryctria amatella (Hulst), to detect feeding and ovipositional preferences for different host-plant materials showed that larvae preferred to feed on host-plant materials with high moisture contents, low wood densities, and low monoterpene contents. Female moths, however, did not necessarily select those materials for feeding, but tended to oviposit more frequently on materials with high monoterpene contents.

N-333 Fatzinger, Carl W.; Yates, Harry O., III; Hammond, William J. [and others]. **Insect-caused cone and seed losses in treated and untreated loblolly pine seed orchards.** Res. Note SE-333, Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 4 pp.

Differences in strobilus survival and yields of viable seed were estimated between ramets of the same four clones of loblolly pine, Pinus taeda L., in two differently managed seed orchards. One orchard had been treated with insecticides, fertilizers, and various cultural practices, whereas the other orchard had not been treated. The more intensive management practiced in the treated orchard resulted

in increased strobilus production and survival as well as increased yields of viable seed per cone.

R-933 Gaby, Louis I.
Treating and drying composite lumber with waterborne preservatives: Part 2. Joist treating and drying. Forest Products Journal 35(5):25-27; 1985.

Southern pine composite joists were made with several types of core and were impregnated commercially with CCA preservative. Treatment was followed by kiln-drying in the laboratory using two schedules. Retention of preservative in composite joists compared very favorably with retentions of sawed joists treated in the same charge.

N-327 Geary, T.F.; Lutz, A.D.
Age and size of coppice cuttings influence eucalyptus rooting in southern Florida. Res. Note SE-327. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 7 pp.

Eucalyptus grandis and E. robusta cuttings that root easily can be produced in southern Florida; the problem is to produce enough of them at the right time of year to support a plantation program.

P-251 Gorse, August H., IV; Cubbage, Frederick W.; Saucier, Joseph R.
Fuelwood harvesting in mountain hardwood stands; tests of a cable skidder and a small skyline yarder. Res. Pap. SE-251. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 17 pp.

A case study of fuelwood harvesting in mountain hardwood stands with a small skidder and a skyline yarder. Both machines were underutilized when observed, leading to large average costs.

R-934 Harpole, George B.
Economics of manufacturing structural lumber from low-to-medium-density hardwoods. Res. Pap. FPL 432. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory; 1983. 4 pp. [Available from Southeastern Forest Experiment Station, Asheville, NC]

Economic analysis indicates that mills using the Saw-Dry-Rip system can manufacture structural lumber from low- and medium-density hardwoods at an attractive cost.

R-935 Knight, Herbert A.
Southern U.S. timber supplies. Proceedings, 3d North American international institute for applied systems analysis network meeting; 1985 March 21-23; Victoria, BC. 1985:27-37. [Available from Southeastern Forest Experiment Station, Asheville, NC]

A recent, unexpected downturn in the net annual growth of softwood timber in the Southern United States clouds the prospective outlook for timber supplies in this important softwood region. Causes include a decline in area of timberland, inadequate regeneration following harvesting, an increase in mortality, and a slowdown in individual tree diameter growth in the southeastern upland regions.

N-329 Kormanik, Paul P.; Schultz, Richard C.
Significance of sewage sludge amendments to borrow pit reclamation with sweetgum and fescue. Res. Note SE-329. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 7 pp.

Sweetgum (Liquidambar styraciflua L.) and fescue (Festuca arundinocea Schreb.) were planted after subsoiling and sludge applications to reclaim a borrow pit in the Lower Piedmont of South Carolina. Sludge treatments in combination with subsoiling significantly improved establishment of fescue and growth of sweetgum, but all combinations of fescue with sludge significantly reduced first-year survival of sweetgum.

R-936 Lewis, Clifford E.; Tanner, George W.; Terry, W. Stephen
Double vs. single-row pine plantations for wood and forage production. Southern Journal of Applied Forestry 9(1):55-61; 1985.

To find planting patterns for growing high volumes of wood while maintaining forage for cattle and wildlife habitat, slash pine (Pinus elliottii Engelm.) was planted in various configurations to increase the open space between rows while holding tree density constant. Thirteen years after planting, double-row configurations produced more forage than single-row. This configuration offers a high timber volume and forage mass alternative to the currently favored 8- by 12-foot spacing used for dual resource management.

N-335 Loftis, David L.
A precommercial thinning in yellow-poplar. Res. Note SE-335. Asheville, NC:

U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 4 pp.

Seven years after a precommercial thinning in a 15-year-old yellow-poplar plantation, mean d.b.h. of crop trees was 0.8 inch greater, instantaneous diameter growth rate of crop trees remained higher, and total stand basal-area growth had been greater in the thinned stand than in an unthinned control.

N-330 McAlister, Robert H.
Effect of accelerated aging on the bending strength and stiffness of COM-PLY® truss lumber produced in a pilot plant. Res. Note SE-330. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 6 pp.

COM-PLY® truss lumber produced in a pilot plant was subjected to the ASTM D 1037 6-cycle accelerated aging test. Actual reductions in stiffness and strength amounted to much less than the 50 percent reduction allowed in the proposed standards.

R-937 McAlister, Robert H.
Effects of two methods of accelerated aging on strength and stiffness of composite structural lumber. Forest Products Journal 35(5):45-47; 1985.

COM-PLY® truss lumber produced in a pilot plant was tested for durability by using two different accelerated aging procedures. Accelerated aging strength loss was about 30 percent and stiffness loss about 20 percent for both procedures.

R-938 McMahon, Charles K.; Bush, Parshall B.; Woolson, Edwin A.
Release of copper, chromium, and arsenic from burning wood treated with preservatives. 16 pp. [Presented at 78th Annual Meeting of the Air Pollution Control Association, Detroit, MI, June 1985.]

Tests were performed in a horizontal tube furnace under dynamic flow conditions using various time/temperature combinations. Under various combustion conditions, small amounts of copper and chromium were evolved; amounts of arsenic varied widely.

R-939 McMinn, James W.
Whole-tree harvesting affects pine regeneration and hardwood competition. Southern Journal of Applied Forestry 9(2): 81-84; 1985.

Mixed upland hardwood-pine stands of low quality in the Upper Piedmont of Georgia were whole-tree harvested to 1-inch and 4-inch diameter limits in both winter and summer. Early pine establishment was generally successful after winter harvesting but not after summer harvesting. Pine regeneration was excellent following the 1-inch winter harvest and acceptable following the 4-inch winter harvest.

R-940 McReynolds, Robert D; Gansel, Charles R.
High-gum-yielding slash pine: performance to age 30. Southern Journal of Applied Forestry 9(1):29-32; 1985.

Portions of the Nation's first slash pine (Pinus elliottii Engelm.) progeny test, planted at Olustee, FL, were chipped commercially for naval stores, and tree

volumes were measured up to age 30. Yields were highest if both parents were high-yielding trees. High-gum-yielding progeny also produced as much wood as average-yielding progeny.

R-941 Maeglin, Robert R.; Boone, R. Sidney. **Manufacture of quality yellow-poplar studs using the Saw-Dry-Rip (S-D-R) concept.** Forest Products Journal 33(3): 10-18; 1983.

Among four sawing and drying treatments evaluated, Saw-Dry-Rip with high-temperature drying was the most effective for minimizing warp in yellow-poplar studs.

R-942 Maeglin, Robert R.; Boone, R. Sidney **Manufacturing quality structural lumber from hardwoods using the Saw-Dry-Rip process.** In: Proceedings, 9th annual hardwood symposium of the Hardwood Research Council; 1981 May 25-28; Pipestem, WV. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory; 1981:29-45. [Available from Southeastern Forest Experiment Station, Asheville, NC]

The Saw-Dry-Rip process is a simple system for sawing and drying low- and medium-density hardwoods for structural lumber.

R-943 Marx, D.H.; Cordell, C.E.; Kenney, D.S. [and others]. **Commercial vegetative inoculum of *Pisolithus tinctorius* and inoculation techniques for development of ectomycorrhizae on bare-root tree seedlings.** Forest Science Monograph 25:101; 1984.

A description of long-term successful efforts to produce Pisolithus tinctorius inoculum on a commercial scale at Abbott Laboratories and of studies of inoculum effectiveness at 33 tree nurseries.

P-249 Marx, Donald H.; Bell, Wayne
Formation of Pisolithus ectomycorrhizae on loblolly pine seedlings with spore pellet inoculum applied at different times. Res. Pap. SE-249. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985, 6 pp.

Spore pellets of Pissolithus tinctorius (Pt) were applied to fumigated soil in loblolly pine microplots at April sowing and monthly through September 1983. High and low rates of application at sowing and the high rate at May were the only pellet treatments to result in Pt indices of >50 for seedlings by lifting time in January.

R-944 Meyer, Wendy L.; Cameron, R. Scott; Tamhankar, Ashok [and others].
Sex pheromone of the blister coneworm moth, Dioryctria clarioralis (Lepidoptera: Pyralidae). Environmental Entomology 13(3):854-858; 1984.

Male blister coneworm moths were attracted to a synthetic blend of three acetates. Males of a sympatric species, Dioryctria merkeli, were attracted to traps containing blends of two of the acetates but not to traps containing virgin female blister coneworm moths.

R-945 Namkoong, G.; Gregorius, H.-R.
Conditions for protected polymorphisms in subdivided plant populations. 2. Seed versus pollen migration. The American Naturalist 125(4):521-534; 1985.

The effects of sexually variable migration and selection are explored within the general context of Wright's island model of migration. An analysis for the development of protection of polymorphisms is constructed for a migratory system in which pollination is strictly localized within mating-selection demes, but fertilized seed from each deme create a zygotic pool for regenerating all demes.

R-946 Namkoong, Gene
Genetic structure of forest tree populations. In: Genetics: new frontiers. Proceedings, 15th international congress of genetics; 1983 December 12-21; New Delhi. New Delhi, Bombay, Calcutta: Oxford & UBH Publishing Co.; 1984: 351-360.

A new concept is introduced for the joint management of gene conservation and tree breeding programs. A proposed management strategy includes the use of in situ and ex situ programs.

R-947 Namkoong, Gene
Strategies for gene conservation in forest tree breeding. In: Yeatman, Christopher W.; Kafton, David; Wilkes, Garrison, eds. Plant genetic resources: a conservation imperative. Boulder, CO: Westview Press; 1984:79-89.

Gene conservation strategies may not be effective in individual breeding programs, and cooperative interagency programs would be desirable.

R-948 Nord, J.C.; DeBarr, G.L.; Barber, L.R. [and others].
Low-volume applications of azinphosmethyl, fenvalerate, and permethrin

for control of coneworms (Lepidoptera: Pyralidae) and seed bugs (Hemiptera: Coreidae and Pentatomidae) in southern pine seed orchards. Journal of Econmic Entomology 78(2):445-450; 1985.

Mist-blower applications of azinphosmethyl or fenvalerate and permethrin repeated five or six times at monthly intervals effectively controlled coneworms, Dioryctria spp., in loblolly pine, Pinus taeda L., seed orchards in South Carolina but were less effective in Louisiana. These pilot tests demonstrated that large increases in cone survival and seed yields can be attained in production seed orchards.

R-949 Outcalt, Kenneth W.; Brendemuehl, Raymond H. Growth of Choctawhatchee sand pine plantations in Georgia. Southern Journal of Applied Forestry 9(1):62-64; 1985.

Surveys of establilshed plantations of Choctawhatchee sand pine (Pinus clausa var. immuginata Ward) on sandhills in 10 Georgia counties showed that the observed growth is better than could be expected from other pine species on these excessively drained, infertile sites.

R-950 Robbins, Kathryn
Annosus root rot in eastern conifers. For. Insect & Dis. Leafl. 76. Washington, DC: U.S. Department of Agriculture, Forest Service; 1984. 10 pp.

A brief description of the disease and its prevention. Contains color photos.

R-951 Ruehle, John L.
The effect of cupric carbonate on root morphology of containerized mycorrhizal

pine seedlings. Canadian Journal of Forest Research 15(3):586-592; 1985.

Loblolly, longleaf, shortleaf, and eastern white pine seedlings inoculated with Pisolithus tinctorius (Pers.) Coker & Couch (Pt) were raised in a greenhouse in containers painted with latex paint containing 50 g/L cupric carbonate ($CuCO_3$). The treatment was effective in preventing most first-order laterals of all species from growing down the container wall, and had little effect on ectomycorrhizal formation on loblolly and shortleaf seedlings, but significantly increased it on longleaf seedlings and decreased it on eastern white seedlings.

R-952 Ruehle, John L.
Lateral-root development and spread of Pisolithus tinctorius ectomycorrhizae on bare-root and container-grown loblolly pine seedlings after planting. Forest Science 31(1):220-225; 1985.

Bare-root and container-grown loblolly pine seedlings with Pisolithus tinctorius (Pt) ectomycorrhizae were planted, and during a 22-week period after planting, seedlings were excavated at 4-week intervals. Bare-root seedlings produced 60 percent more laterals and had significantly more Pt ectomycorrhizae on egressed laterals.

R-953 Sowder, Allen; Woodall, Steve
Small mammals of melaleuca stands and adjacent environments in southwestern Florida. Florida Scientist 48(1):44-46; 1985.

Removal trapping in several wetland habitats of the southwestern Florida flatwoods caught only small numbers of Peromyscus gossypinus and Sigmodon hispidus. Results suggest poor utilization of melaleuca habitats but do not indicate appreciably greater utilization of associated non-melaleuca habitats.

R-954 Swank, Wayne T.; Fitzgerald, J.W.; Strickland, T.C.
Transformation of sulfur in forest floor and soil of a forest ecosystem. In: Johansson, Iréne, ed. Hydrological and hydrogeochemical mechanisms and model approaches to the acidification of ecological systems. Proceedings, international hydrological programme (IHP) workshop; 1984 September 15-16; Uppsala, Sweden. 1985:137-145. [Available from Southeastern Forest Experiment Station, Asheville, NC]

Incubation of forest floor and soils containing sulfate labeled with sulfur-35 showed rapid metabolism of the added sulfate to organic sulfur forms by microbial populations.

R-955 Swift, Lloyd W., Jr.
Forest road design to minimize erosion in the southern Appalachians. In: Blackmon, B.G., ed. Proceedings, forestry and water quality: a mid-South symposium; 1985 May 8-9; Little Rock, AR. [Available from Southeastern Forest Experiment Station, Asheville, NC]

Road and erosion research at Coweeta Hydrologic Laboratory in western North Carolina has emphasized development of a low-cost, low-maintenance road design. Results cover

such features as: drainage and the broad-based dip, cut-bank design and stabilization, roadbed surfacing, brush barriers and filter strips, culvert sizing, and transportation planning.

R-956 Swift, Lloyd W., Jr.; Ragsdale, Harvey L. **Meteorological data stations at long-term ecological research sites.** In: Hutchison, B.A.; Hicks, B.B., eds. The Forest-atmosphere interaction: Proceedings, forest environmental measurement conference; 1983 October 23-27; Oak Ridge, TN. Dordrecht, The Netherlands: D. Reidel Publishing Co.; 1985:25-37.

National goals of the Long-Term Ecological Research program and the research objectives at each site are related in this report to specific needs for meteorological data and structure of the station standards.

R-957 Wade, Dale D., comp. **Prescribed fire and smoke management in the South: conference proceedings.** 1984 September 12-14; Atlanta, GA. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 194 pp.

A collection of 18 papers that describe current problems and trends in prescribed fire and smoke management, and the results of discussion groups that present recommendations for continuing research and application.

R-958 Webster, J.R.; Swank, W.T. **Within-stream factors affecting nutrient transport from forested and logged watersheds.** In: Blackmon, B.G., ed. Proceedings, forestry and water quality: a

mid-South symposium; 1985 May 8-9; Little Rock, AR. [Available from Southeastern Forest Experiment Station, Asheville, NC]

Important instream processes affecting nutrient concentrations in stream water include autotrophic and heterotrophic uptake, macroinvertebrate particle generation, and retention of dissolved and particulate nutrients by woody debris. Major changes in these processes occur following forest logging. As a result of these changes, streams in the Southern Appalachian Mountains may have their lowest ability to retain nutrients 20 to 30 after logging.

R-959 White, Jerry D.
Validating a simplified determination of benzo[a]pyrene in particulate matter from prescribed forestry burning. American Industrial Hygiene Association Journal 46(6):299-302; 1985.

A high performance liquid chromatographic method for determining the concentration of trace amounts of benzo[a]pyrene(B[a]P) in particulate matter from combustion of forest fuels was validated. The complete method gave a mean recovery of 100.6 percent across its working range with an 8.3 percent relative standard deviation.

R-960 Wilhite, L.P.; McKee, W.H., Jr.
Site preparation and phosphorus application alter early growth of loblolly pine. Southern Journal of Applied Forestry 9(2):103-109; 1985.

Loblolly pines were grown on three sites with a series of site preparation treatments and differential applications of

herbicide, phosphorus, potassium, and phosphorus plus potassium. Five years after planting, the tallest pines (12 to 15 feet) were on plots that had received the most expensive and most intensive treatment.

N-332 Woodall, Steven L.; Geary, Thomas F. **Identity of Florida casuarinas.** Res. Note SE-332. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 10 pp.

This paper gives taxonomic guides for casuarinas in Florida, and recognizes only three species as having a significant presence in Florida: C. equisetifolia L., C. glauca Sieb. ex Spreng., and C. cunninghamiana Miq. Identifying characteristics are given for each species and for putative hybrids.

The following publication is not available from the Southeastern Station. Please order direct from:

Southern Forest Experiment Station
T-10210, U.S. Postal Service Bldg.
701 Loyola Avenue
New Orleans, LA 70113

Shoulders, Eugene, ed. Proceedings, third biennial southern silvicultural research conference; 1984 November 7-8; Atlanta, GA. Gen. Tech. Rep. SO-54. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station; 1985. 589 pp.

Beck, Donald E.
Is precipitation a useful variable in modeling diameter growth of yellow-poplar?
pp. 555-557.

Cotrufo, Cosimo
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